

INTRODUCTION TO THE SPECIAL ISSUE ON THE BEHAVIOR  
ANALYSIS AND TREATMENT OF DRUG ADDICTION

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Extensive evidence from the laboratory and the clinic suggests that drug addiction can be viewed as operant behavior and effectively treated through the application of principles of operant conditioning. Contingency management interventions that arrange for the direct reinforcement of drug abstinence or of other therapeutically important target behaviors (e.g., regular use of drug abuse treatment medications) are among the most studied type of operant treatments. Behavior analysts have contributed to the substantial and rapidly growing literature on operant treatments for drug addiction, but the publications of this work usually appear in medical, clinical psychology, or drug abuse journals. This special issue of the *Journal of Applied Behavior Analysis* represents an effort to bring this important work to the attention of the behavior-analytic community. The articles in this special issue illustrate both the enormous potential of contingency management interventions to address the serious and seemingly intractable problem of drug addiction as well as the real challenges involved in attempting to develop and disseminate treatments that will produce substantial and lasting changes in the lives of individuals plagued by the chronic problem of drug addiction.

DESCRIPTORS: abstinence reinforcement, contingency management, drug abuse, drug addiction, operant conditioning

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Drug addiction is one of the most serious and costly public health problems in the United States. The National Institutes of Health estimates that drug, alcohol, and cigarette

Preparation of this article was supported by Research Grants DA013107, DA019386, DA019497, DA023864 (Silverman); DA017407, DA14871, DA022476 (Roll); and DA09378, DA08076, DA14028 (Higgins) from the National Institute on Drug Abuse.

This special issue would not have been envisioned or pursued were it not for the open environment that Pat Friman created when he was the editor of *JABA*. To the extent that this issue makes any useful contribution to the behavior-analytic community, Pat deserves credit for creating the conditions that led to its inception.

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doi: 10.1901/jaba.2008.41-471

addiction costs our society about \$500 billion per year, an amount that dwarfs other major medical illnesses (U.S. Office of National Drug Control Policy, 2004). The costs associated with the premature deaths and ruined lives resulting from addictions are incalculable. Some available treatments for addiction have been shown to be effective, but none are effective in all patients, and high relapse rates are the norm rather than the exception (e.g., Hubbard, Craddock, & Anderson, 2003; McLellan, Lewis, O'Brien, & Kleber, 2000; Simpson, Joe, Fletcher, Hubbard, & Anglin, 1999).

Given the enormous cost of drug addiction to individuals and society and the recognized need for effective treatments, the United States federal government, through its National Institute on Drug Abuse (NIDA), has invested large

amounts of money in recent years to fund addiction treatment research. Operant contingency management interventions that arrange explicit reinforcement for engaging in therapeutic behavior change are among the most thoroughly investigated types of addiction treatment. These interventions are firmly grounded in nonhuman and human laboratory models of drug addiction that suggest that drug addiction is an operant behavior that is maintained and modifiable by its consequences (Bigelow & Silverman, 1999). An extensive body of research, reviews, and meta-analyses (e.g., Dutra et al., 2008; Higgins, Silverman, & Heil, 2008; Lussier, Heil, Mongeon, Badger, & Higgins, 2006; Prendergast, Podus, Finney, Greenwell, & Roll, 2006; Roll, 2005) has shown that these interventions have been extremely effective in increasing abstinence from most commonly abused drugs as well as improving adherence to addiction treatment medication regimens and increasing retention in treatment.

Based on this research, major professional health-promotion organizations have recognized that contingency management interventions are among the most effective psychosocial treatments for drug addiction and have recommended their widespread adoption. Most notably, the National Institute for Health and Clinical Excellence (NICE) recently published guidelines for the selection and use of psychosocial interventions for the treatment of drug addiction in the United Kingdom (Pilling, Strang, & Gerada, 2007). One of NICE's three key recommendations was that the United Kingdom's National Treatment Agency for Substance Misuse introduce contingency management to reduce illicit drug use and promote treatment engagement (Pilling et al.).

Despite the substantial body of evidence on the effectiveness of contingency management interventions in the treatment of drug addiction, three major issues remain unresolved and require aggressive and extensive research. First,

even though contingency management interventions are effective for many patients, they fail to produce clear effects in some patients. Thus, research is needed to improve the effectiveness of these interventions so that they succeed in a larger proportion of individuals. Second, like virtually all substance abuse treatments, some patients relapse after the interventions are discontinued. To address this limitation, research is needed to develop methods that will reliably ensure that individuals sustain long-term abstinence outcomes. Finally, although contingency management interventions are becoming increasingly accepted and adopted in clinical practice, they still are not widely used in the United States or elsewhere. Thus, efforts are needed to increase adoption of contingency management interventions in community treatment settings and beyond. The articles in this special issue illustrate both the enormous potential of contingency management interventions to address the serious and seemingly intractable problem of drug addiction and the real challenges involved in attempting to develop and disseminate treatments that will produce substantial and lasting changes in the lives of individuals plagued by the chronic problem of drug addiction.

#### *Applications Across Drugs, Populations, and Contexts*

Contingency management interventions have considerable potential in part because of their remarkable versatility. Papers in this special issue illustrate applications of contingency management interventions in different populations of cigarette smokers, including smokers in methadone treatment (Dunn, Sigmon, Thomas, Heil, & Higgins, 2008), smokers not enrolled in other treatment (Chivers, Higgins, Heil, Proskin, & Thomas, 2008; Dallery, Meredith, & Glenn, 2008; Roll & Howard, 2008), smokers in long-term residential treatment (Alessi, Petry, & Urso, 2008), and adolescent smokers (Reynolds, Dallery, Shroff,

Patak, & Leraas, 2008). Other papers show that these interventions can be used to treat adults who persist in using heroin and cocaine while in methadone maintenance treatment programs (Donlin, Knealing, Needham, Wong, & Silverman, 2008; Ghitza et al., 2008; Preston, Ghitza, Schmittner, Schroeder, & Epstein, 2008), adults enrolled in community drug abuse treatment clinics for a variety of different types of drug addiction (Ledgerwood, Alessi, Hanson, Godley, & Petry, 2008), opiate-dependent adults undergoing outpatient opiate detoxification (Greenwald, 2008), and criminal offenders enrolled in drug court programs (Marlowe, Festinger, Dugosh, Arabia, & Kirby, 2008).

#### *Voucher-Based Reinforcement*

In the early 1990s, a voucher-based reinforcement intervention for the treatment of cocaine dependence was developed that has proven to be one of the most effective and widely used contingency management interventions (Higgins et al., 1991). Under the original intervention, patients provided urine samples three times per week and could earn vouchers for providing cocaine-free urine samples. The vouchers had monetary values and could be exchanged for goods and services. The voucher intervention used a novel schedule of escalating reinforcement for sustained abstinence in which the monetary value of the vouchers increased as the number of consecutive cocaine-free urine samples increased and reset contingent on drug-positive urine toxicology results or failure to provide a scheduled specimen. The effectiveness of this voucher intervention promoted increased interest in contingency management interventions in the research community and prompted the development of variations of the voucher intervention or novel interventions that incorporated features of the voucher procedure. Most of the papers in this issue report studies of voucher reinforcement or interventions that were adapted from the voucher intervention.

Dunn et al. (2008) applied the voucher intervention to initiate smoking cessation in a population of adults who were enrolled in methadone maintenance treatment for opioid addiction. As described by Dunn et al., an alarmingly high proportion of adults in methadone treatment programs smoke cigarettes and suffer considerable adverse effects to their health and welfare because of their smoking. Dunn et al. examined the effectiveness of an intensive voucher-based abstinence reinforcement intervention designed to initiate smoking cessation during the initial weeks of a quit attempt, the period that has been shown in other research to be critical to achieving longer term abstinence. Employing a randomized group design and a yoked noncontingent voucher control group, Dunn demonstrated the effectiveness of the voucher-based reinforcement contingency in initiating smoking cessation in this population. This study provides a simple but powerful illustration of the potential utility of voucher-based abstinence reinforcement in the treatment of drug addiction.

#### *Improving Effectiveness*

Some of the articles in this issue address the problem of improving the effectiveness of contingency management interventions in the treatment of drug addiction. Over the past 15 years, Kenzie Preston and her colleagues at NIDA's Intramural Research Program have conducted a long line of rigorous, systematic, and carefully controlled research on the use of reinforcement contingencies to promote abstinence from opiates and cocaine in adults enrolled in methadone maintenance treatment (Epstein & Preston, 2008). Abstinence reinforcement interventions have been effective in promoting abstinence from multiple drugs, but analyses across studies have suggested that reinforcing abstinence from multiple drugs (e.g., heroin and cocaine) can be more difficult than reinforcing abstinence from a single drug (e.g., cocaine alone). However, relatively little

research has been conducted to evaluate this issue directly within controlled studies. The study by Preston *et al.* (2008) addressed this issue directly in a carefully controlled randomized trial that compared the effectiveness of reinforcing abstinence from cocaine only to reinforcing abstinence from opiates and cocaine simultaneously.

In an effort to develop a contingency management intervention that is more effective and might be useful in community drug abuse treatment clinics, Kirby, Kerwin, Carpenedo, Rosewasser and Gardner (2008) explored the use of interdependent group contingencies in a methadone maintenance treatment clinic. Under the interdependent group contingency, the behavior of a randomly selected and anonymous individual in the group determined the reinforcement delivered to all members in the group. This contingency has the potential of recruiting social reinforcement contingencies between group members to increase desired target behaviors, which could augment financially based contingencies imposed by the clinic. This study makes a unique contribution to this special issue for a few reasons. First, this study adapted a behavior-analytic intervention (interdependent group contingencies) that had proven effective with other populations and other behavior problems and applied it to the treatment of drug addiction. This kind of adaption of proven behavior-analytic interventions could be potentially invaluable to treatment of drug addiction and will hopefully serve as a model to other addiction treatment researchers. Second, given the potential risks of group contingencies (e.g., potential coercion between participants), simply conducting such an investigation must have been difficult and possibly intimidating. However, we need to increase the effectiveness and general utility of our contingency management interventions; testing the group contingency was a reasonable step in this effort. Kirby *et al.* took great care in monitoring and managing the potential risks of the group contingency. Finally, although the

findings of this study are modest, they do provide a reasonable foundation for future research on group interdependent contingencies in the treatment of drug addiction.

Roll and Howard (2008) examined a novel question, not addressed in prior research, about whether contingency management interventions should provide reinforcers contingent on abstinence or remove reinforcers contingent on use. Although the differences between gain and loss contingencies were not robust, this pilot study provides some preliminary data that suggest a relative benefit of the gain contingency.

In recent years, Higgins and his colleagues have conducted a systematic program of research that uses abstinence reinforcement interventions as a tool to investigate factors that influence relapse to smoking during the initial days and weeks of a quit attempt. Using abstinence reinforcement contingencies, these investigators have been able to experimentally manipulate when and how long individuals initiate abstinence. As described in the paper by Chivers *et al.* (2008), this line of research has provided important information on the effectiveness of abstinence reinforcement contingencies in promoting smoking cessation and on factors that can compromise or enhance that effectiveness. The Chivers *et al.* study provided additional and unequivocal evidence of the effectiveness of abstinence reinforcement contingencies in initiating smoking cessation. Contrary to expectations, the study also showed that experimentally scheduled lapses did not affect relapse to smoking while participants were under the influence of an abstinence reinforcement intervention. Although this result was somewhat unexpected, it provided a novel illustration of the remarkable ability of the abstinence reinforcement contingencies to maintain abstinence, even when participants were experimentally exposed to brief smoking lapses.

The technical article by Husky *et al.* (2008) illustrates the potential utility of the experience

sampling method (ESM) to monitor behavior that individuals emit throughout their daily lives. Using cell phones, these investigators contacted participants at random times repeatedly within and across days and asked them a series of questions regarding their current environments (e.g., where were they, who were they with), how they were feeling, and their recent drug use. The respondents were participants in a study that exposed some of them to contingency management interventions designed to arrange reinforcement for cocaine abstinence. The paper provides a useful description of how ESM can be applied and suggests how more extensive use of this method could help discover both the indirect effects of contingency management interventions on nondrug behaviors and the relations between environmental circumstances and drug use. Both types of information could potentially be useful in the development and improvement of contingency management interventions for the treatment of drug addiction.

### *Dissemination*

Despite the proven effectiveness of contingency management interventions, they have not been used widely in routine clinical practice. As illustrated by some of the articles in this issue, a number of investigators have conducted research to increase the dissemination of contingency management interventions.

*Reducing cost.* Most efforts to increase the dissemination of contingency management interventions have focused on reducing their cost, and several articles in the special issue make valuable contributions to the literature on this topic. The article by Garcia-Rodriguez, Secades-Villa, Higgins, Fernandez-Hermida, and Carballo (2008) provides an impressive illustration of how costs of voucher-based reinforcement interventions might be reduced by recruiting community donations. As reviewed by Garcia-Rodriguez et al., community donations have been shown to be useful in

funding voucher programs in previous research. Their results are particularly noteworthy because their community donation program was conducted in Spain. This study demonstrates the feasibility of recruiting community donations in a culture outside North America and provides a demonstration of the acceptability of voucher reinforcement to public and private businesses in Spain.

In recent years, researchers have attempted to reduce the cost of monetary-based reinforcement by using a procedure that arranges reinforcers of variable magnitude. Under this procedure, called prize-based reinforcement, participants earn the opportunity to draw from a bowl that contains tokens contingent on emitting a desired target behavior (e.g., by providing a drug-free urine sample). To program variable magnitude reinforcement, different tokens in the bowl represent different reinforcement magnitudes. The tokens are marked "small prize," "large prize," "jumbo prize," or "good job" and can be exchanged for small prizes, large prizes, jumbo prizes, or no prize, respectively. To arrange the escalating reinforcement for sustained abstinence embedded in the voucher-based reinforcement schedule (Higgins et al., 1991), under prize-based reinforcement, the number of draws from the bowl increases as the participant's duration of sustained behavior (e.g., abstinence) increases. In applications of prize-based reinforcement, investigators can vary the proportions of "small prize," "large prize," "jumbo prize," or "good job" tokens, as well as the values of the small, large, and jumbo prizes. The hope among users of prize-based reinforcement is that the schedule of variable reinforcement magnitude is more effective than procedures that do not employ the variable magnitude schedule and can produce the same treatment outcomes at a lower cost. A number of studies have shown that the prize-based reinforcement intervention can be effective in promoting abstinence and treatment attendance, including large multisite

studies conducted in the NIDA's Clinical Trials Network (Peirce *et al.*, 2006; Petry, Peirce, *et al.*, 2005). The paper by Ledgerwood *et al.* (2008) provides evidence that this prize-based intervention could be applied effectively by community treatment providers with relatively little training, and the paper by Alessi *et al.* (2008) provides some evidence that the intervention can be used to promote smoking cessation in patients enrolled in a residential substance abuse treatment program.

Even though prize-based reinforcement is clearly an effective and useful contingency management intervention, the cost savings of this approach have not been demonstrated. Indeed, several randomized controlled trials have compared the prize-based system to the more commonly used voucher-based system and have shown no significant differences in outcome when the two systems were arranged such that maximal earnings were comparable (Petry, Alessi, Hanson, & Sierra, 2007; Petry, Alessi, Marx, Austin, & Tardif, 2005). Perhaps most important, studies have not systematically manipulated the probability of earning actual prizes or the inclusion of different-sized prizes to determine if those features offer any advantage or cost savings. Ghitza and colleagues have addressed these critical issues in their recent research (Ghitza *et al.*, 2007, 2008). Their paper in this special issue (Ghitza *et al.*, 2008) provides an impressive analysis that suggests that the amount of abstinence produced by prize-based reinforcement is directly related to the probability of reinforcement. These data suggest that the variable magnitude reinforcement schedule used in prize-based reinforcement may be used to reduce the cost of the procedure, but it simultaneously reduces its effectiveness. Thus, at this point in the development of contingency management interventions, it appears that costs can be lowered by delivering variable magnitude reinforcement or lowering the magnitude of the reinforcers without totally eliminating efficacy. However,

each of those cost-saving manipulations does appear to reduce the size of the treatment effects obtained (Ghitza *et al.*, 2008; Lussier *et al.*, 2006).

Also aiming to reduce costs and facilitate dissemination, Dallery and Glenn (2005) have developed a Web-based contingency management system for smoking cessation that represents one of the most important innovations in this field in recent years. Under typical contingency management programs for smoking cessation, smokers exhale into carbon monoxide (CO) monitors that provide objective evidence of recent smoking or abstinence. Individuals receive vouchers or some other reinforcer for providing CO samples that indicate that the person had been abstinent recently (*i.e.*, negative CO samples). Unfortunately, CO samples can only confirm abstinence over a period of several hours. As a result, to demonstrate continuous abstinence over an extended period of time, participants in contingency management programs are typically required to provide multiple CO samples every day. This requirement adds considerable costs to the smokers seeking treatment who are required to travel to the smoking clinic multiple times per day and to the treatment program staff who need to be available to collect the samples. As an alternative to these relatively costly procedures, Dallery and Glenn developed a novel approach in which participants provide CO samples in front of a Web camera and then transmit time-stamped video recordings of the sample collections (including pictures of the CO monitor result) to the treatment staff. Using this procedure, patients can provide multiple CO samples per day without leaving their homes or offices. This efficient intervention has been effective in controlled studies and has the potential to revolutionize smoking cessation programs.

The special issue includes two papers that use this Web-based smoking cessation program. The paper by Reynolds *et al.* (2008) tested this

intervention in adolescent smokers and provides preliminary data on its effectiveness with this population. Developing an efficient and effective smoking cessation intervention for adolescent smokers is extremely important and could dramatically reduce the overall rates of smoking and the associated costs to society. The paper by Reynolds et al. takes a useful step in this direction.

To further increase the financial feasibility of disseminating smoking cessation contingency management interventions, Dallery et al. (2008) reported a study in this issue that examined the feasibility and effectiveness of using deposit contracting in conjunction with the Web-based contingency management intervention. Under the deposit contracting procedure, smokers are required to submit a monetary deposit at the start of the treatment, which they can earn back under a smoking cessation contingency management program. The use of deposit contracting in conjunction with the Web-based smoking cessation procedure could be an effective and practical way to disseminate smoking cessation programs to many smokers. The study by Dallery et al. provides some initial data on the feasibility and effectiveness of this approach.

*Harnessing community reinforcers.* Efforts to reduce the cost and increase the financial feasibility of contingency management interventions are critically important and should facilitate the use of contingency management interventions in community treatment clinics and elsewhere. However, the data on contingency management interventions reported in this issue and elsewhere show that for some patients, low-cost or short-term clinic-based contingency management interventions may need to be augmented by other interventions that can increase their effectiveness and maintain effects over time. To achieve these goals, some researchers have attempted to identify and harness high-magnitude and sustainable reinforcers that are available in the community for use in contingency management interventions.

Drug courts could be ideal contexts for the systematic application of contingency management interventions. These specialized courts are intended to treat rather than incarcerate nonviolent offenders who have substance abuse problems, and they have several features that should allow for the systematic identification and application of effective contingency management interventions. Administered by judges who wield considerable power, drug courts can and do (a) require participants to engage in therapeutic activities (e.g., drug abuse treatment), (b) require random urine testing to monitor drug use, (c) control and manipulate powerful reinforcers (freedom vs. incarceration) for following and violating prespecified behavioral goals (e.g., drug abstinence), and (d) arrange supplementary reinforcement contingencies for desirable behaviors. Marlowe et al. (2008) reported a large-scale randomized control study that evaluated the effectiveness of a supplementary contingency management intervention in a felony preadjudication drug court. Although the study did not show clear effects of the contingency management intervention, it illustrated extremely important points for the behavior-analytic community. The study demonstrated the feasibility of implementing a large-scale clinical trial to evaluate a contingency management intervention in the context of an active drug court and documented the willingness of judges and the court staff to participate in such investigations. Furthermore, as thoughtfully discussed by Marlowe et al., the study also illustrated the challenges of implementing contingency interventions in a complex, real-world context like the drug court, where there may be pressures to adjust parameters of the reinforcement contingencies to conform more closely to routine court practices. Behavior analysts, firmly grounded in the principles of operant conditioning, could be uniquely suited to apply and manipulate contingency management interventions in such novel and challenging contexts. Focusing on

how to maximize the efficacy of what might be considered the more fundamental contingencies that operate in the drug courts around participating in treatment, abstaining from drug use, and freedom and incarceration seems like an especially important future research topic. Drug courts represent a potentially powerful arrangement for affecting the addiction problems of large segments of the drug-abusing population throughout the U.S. Systematically applying in the drug court setting what is already known about contingencies is an important priority, as is conducting research to develop a highly effective and evidence-based national model.

Over the past several years, Silverman and his colleagues have been exploring the potential of using workplaces as vehicles for arranging reinforcement contingencies for drug abstinence and other therapeutically important behaviors (e.g., Silverman, 2004). Workplaces have several features that could make them ideal vehicles for administering reinforcement contingencies in the treatment of drug addiction. Perhaps most important, workplaces control high-magnitude and sustainable reinforcers (most notably wages) that can be arranged contingent on abstinence or other therapeutically important behaviors. In this issue, Donlin *et al.* (2008) present a study that provides a systematic replication of the effectiveness of employment-based reinforcement in promoting abstinence from cocaine in a population of adults who were enrolled in community methadone treatment and show that the rates at which individuals attend a workplace before an employment-based reinforcement contingency is implemented can predict the effectiveness of the employment-based reinforcement contingency. As discussed by Donlin *et al.*, these data extend early laboratory data in nonhumans on reinforcement theory and suggest ways of enhancing employment-based reinforcement contingencies prior to their implementation.

### *Context and Expectations*

The articles in this special issue represent a small sample of the many studies that have been

conducted over more than 30 years on the use of contingency management interventions in the treatment of drug addiction. Much of that research is summarized in a recent book entitled *Contingency Management in Substance Abuse Treatment* (Higgins *et al.*, 2008). In this special issue, Madden (2008) provides an insightful review of that book. However, in his article, Madden provides more than a typical book review. He explains the societal and scientific context for contingency management research, succinctly summarizes the major contributions of the field, and offers an inspiring expectation for the future of this field.

In his review, Madden (2008) accurately suggests that more research will be required to improve operant treatments for drug addiction and to facilitate their widespread dissemination. The prospects for these research efforts should be enhanced if behavior analysts contribute to this field. Unfortunately, few graduate programs in behavior analysis offer specializations in drug addiction, and many behavior analysts are unaware of much of the research in this field. This special issue was intended to bring research on operant treatments for drug addiction to the attention of behavior analysts. As Madden noted in his review, extensive research applying operant conditioning principles to the treatment of drug addiction has now filled two edited books and has been published in a range of high-visibility medical, clinical psychology, and addiction journals. Yet only a small, negligible fraction of this work has appeared in the *Journal of Applied Behavior Analysis*. We hope that this special issue will bring this important research area to the attention of behavior analysts who may not otherwise see this work.

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